

## ORGANIZATION OF ANALYSIS

1. The following rigorous computer analysis was performed where the tower was analyzed with the use of a high capacity proprietary program, on a Digital VAX-11/730 computer, as beam-column on elastic supports. All secondary effects such as external moments produced by the guys at each level and those produced by beam-column action were taken into consideration. In addition, thermal gradients, wind escalation, wind thrusts on the tower and appurtenances, gravity loads, as well as drag and lift wind forces on the guys, were solved simultaneously by the computer program using the finite element method. The tower was analyzed with the wind direction normal to a tower face (Wind A); normal to a tower apex (Wind B); and parallel to a tower face (Wind C).

- a) Case 3. Tower in its assumed configuration under a 75 mph basic wind velocity and no ice, in accordance with EIA/TIA Standard 222-E specifications and the following antenna and transmission line loading:

<u>Antenna</u>	<u>Elev. (Ft.)</u>	<u>Transmission Line</u>
yagi	29 ft.	7/8" Heliax
Whip	98 ft.	7/8" Heliax
Whip	119 ft.	7/8" Heliax
3-Bay Communication	180 ft.	1-5/8" Heliax
8-Element	190 ft.	1-5/8" Heliax
4' Dish w/Radome	230 ft.	1-5/8" Heliax
Whip	289 ft.	7/8" Heliax
Whip	363 ft.	7/8" Heliax
Whip	375 ft.	7/8" Heliax
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Whip	486 ft.	7/8" Heliax
Whip	501 ft.	7/8" Heliax
Whip	511 ft.	7/8" Heliax
Whip	523 ft.	7/8" Heliax
Whip	537 ft.	7/8" Heliax
Long Whip	549 ft.	1-5/8" Heliax
	to	
	629 ft.	
2-Bay FM	645 ft.	3" Heliax
Whip	650 ft.	7/8" Heliax
	Top	1" Conduit
Alan Dick	Top	(1) 3-1/8" Rigid
Supertturnstile		Coax
Channel 2		

The type, size, location and number of antennas were taken from sketch of tower prepared by Gerhold, Cross & Etzel, Professional Land Surveyors, Dated 1/20/92. The existing transmission lines sizes and types were assumed. All the assumed 7/8" and 1-5/8" Heliax transmission lines were considered in three bundles. The type of Channel 2 antenna and its transmission line were assumed.

b) Case 4. Same as in Case 3 above, except all the assumed 7/8" and 1-5/8" Heliax transmission lines were considered in one bundle up the tower.

2. For all computer runs the results are given as follow:

- a) Tower loads, kips.
- b) Guy weights, kips.
- c) Guy unstressed length, feet.

- d) Guy forces and reactions, kips.
- e) Spring constants for wind and normal to wind directions.
- f) Column buckling evaluation parameter for the tower shaft between guy levels.
- g) Tower deflections with the tower bending in two directions (if unsymmetrical loads exist) at each tower shaft panel point.
- h) Tower reactions, moments and vertical loads for the wind and normal to wind directions.
- i) Shears and forces (tension or compression) in all tower structural members.

### 3. Allowable Member Loads & Guy Cable Safety Factors:

- a) Allowable Member Loads: For towers less than 700 ft. in height, in accordance with the provisions of EIA/TIA Standard 222-E, the allowable member loads calculated based on the AISC Manual of Steel Construction Formulas may be increased by a factor of 1.33.
- b) Allowable Guy Cable Safety Factors: For towers less than 700 ft. in height, in accordance with EIA/TIA Standard 222-E, the guy cable minimum safety factor requirement is 2.00.

## FINDINGS & EVALUATION

A structural study of the assumed tower geometry, member sizes and the computer analysis of Cases 3 & 4 indicates the following:

1. Under Case 3. Tower in its assumed configuration and antenna and transmission line loading as described in the Organization of Analysis Section of this Report, under a 75 mph basic wind velocity and no ice in accordance with EIA/TIA Standard 222-E.
  - a) The tower legs are overstressed in approximately 30% of the tower by as much as 68%.
  - b) The deflection at the top of the tower is too excessive compared to the rest of the tower. This results in uneven distribution of bending moments in the tower and large overstresses in the tower legs.
  - c) The column buckling evaluation parameter for the tower shaft between guy levels (PHI) is over 1.5 which indicates possible column instability.
2. Under Case 4. Tower in its assumed configuration and antenna and transmission line loading as described in the Organization of Analysis Section of this Report, under a 75 mph basic wind velocity and no ice in accordance with EIA/TIA Standard 222-E.
  - a) The tower legs are overstressed in approximately 30% of the tower by as much as 68%.

- b) The deflection at the top of the tower is too excessive compared to the rest of the tower. This results in uneven distribution of bending moments in the tower and large overstresses in the tower legs.
  - c) The column buckling evaluation parameter for the tower shaft between guy levels (PHI) is over 1.5 which indicates possible column instability.
3. It is my engineering opinion that, due to the large overstresses calculated in the tower legs, the subject tower is not adequately designed to support the Channel 2 antenna and its transmission lines as described in the Organization of Analysis Section of this Report. Therefore, I strongly recommend that the subject tower must not be used for the installation of the Channel 2 Antenna.
4. The Findings presented in this section are based on the assumed tower geometry, member sizes and properties, guy cable sizes, and the antenna and transmission line loading described herein.
5. The tower height, span lengths, guy anchor distances and the antenna loading were taken from the sketch of tower prepared by Gerhold, Cross & Etzel, Professional Land Surveyors, dated 1/20/92.

No ice loading was considered in this analysis. Any significant icing of the tower and its guy cables, in addition to wind loading specified for this geographical area, will put the tower and surrounding area in serious danger.

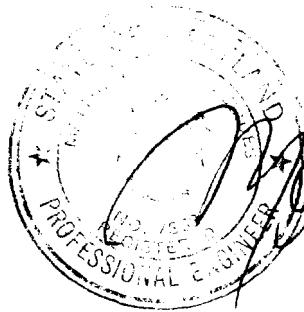
The Computer Analysis Results show the safety factors of the guys and the deflection curve for the tower under Cases 3 & 4. The Computer Analysis Results also list the maximum leg and diagonal loads per tower section.

#### REPLACEMENT TOWER

The engineering estimate to build a new tower 666 ft. in height on the same site to support the Channel 2 antenna, in accordance with EIA/TIA Standard 222-E, is \$350,000.00.

Due to the nature of this Engineering Investigation, I disclaim any liability arising from original design, geometry, material, fabrication and erection deficiencies or the "As Built" condition of the tower. Furthermore, the information and conclusions contained in this Report were determined by application of the current "state-of-the-art" engineering and analysis procedures and formulae, and Vlissides Enterprises, Inc. (Matthew J. Vlissides, P.E.) assumes no obligations to revise any of the information or conclusions contained in this Report in the event that such engineering and analysis procedures and formulae are hereafter modified or revised. In addition, under no circumstances will Vlissides Enterprises, Inc. (Matthew J. Vlissides, P.E.) have any obligations, responsibility or liability whatsoever for or on account of consequential or incidental damages sustained by any person, firm or organization as a result of any information or conclusions contained in this Report.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.



Matthew J. Vlissides, P.E.  
2/24/92

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Matthew J. Vlissides, P.E.  
Engineering Consultant

**SECTION B**

PART I  
COMPUTER INPUT CALCULATIONS

COMTRAN/ GUYED TOWER ANALYSIS  
JOB: 666 Ft. Guyed Tower - REVISED ANALYSIS - 75 MPH Basic Vel., EIA 222E

3 SIDES

7 SPANS

33 SECTIONS

MISC 5.00% WEIGHT

MISC 0.00% AREA

BASE PTER ELEVATION = 1.00

GUST RESPONSE FACTOR (Gh) = 1.04

BASIC WIND VELOCITY = 75.00

WIND ANGLE = 0

THIS RUN USED VERSION EIA 222-E

SPAN DATA

SPAN	LENGTH (FT)	WIND PRES (PSF)	WEIGHT (KIPS)	WIND LOAD (KIPS)	AVERAGE I (INFT)*#2	SYST TORS STIFF TYPE	(KIP-FT)
1	93.500	16.928	5.098	2.058	24.209	N	104.230
2	95.167	22.455	5.155	2.792	24.209	N	104.230
3	95.167	26.295	5.155	3.041	24.209	N	104.230
4	95.167	28.975	5.155	3.571	24.209	N	104.230
5	94.500	31.138	5.119	3.811	24.209	N	104.230
6	95.167	33.978	4.563	4.065	19.556	N	104.230
7	94.472	34.591	4.294	4.231	17.891	N	104.230

## SECTION DATA

SEC	PANEL HT (FT)	FACE WIDTH (FT)	LENGTH (FT)	SHAPE FACTOR CF	SDL-RATIO <i>e</i>	ROUND S/F <i>Rr</i>
1	5.000	4.000	18.500	2.568	0.209	0.592
2	5.000	4.000	20.000	2.583	0.204	0.591
3	5.000	4.000	20.000	2.583	0.204	0.591
4	5.000	4.000	20.000	2.583	0.204	0.591
5	5.000	4.000	20.000	2.583	0.204	0.591
6	5.000	4.000	20.000	2.583	0.204	0.591
7	5.000	4.000	20.000	2.583	0.204	0.591
8	5.000	4.000	20.000	2.583	0.204	0.591
9	5.000	4.000	20.000	2.583	0.204	0.591
10	5.000	4.000	20.000	2.583	0.204	0.591
11	5.000	4.000	20.000	2.583	0.204	0.591
12	5.000	4.000	20.000	2.583	0.204	0.591
13	5.000	4.000	20.000	2.583	0.204	0.591
14	5.000	4.000	20.000	2.583	0.204	0.591
15	5.000	4.000	20.000	2.583	0.204	0.591
16	5.000	4.000	20.000	2.583	0.204	0.591
17	5.000	4.000	20.000	2.583	0.204	0.591
18	5.000	4.000	20.000	2.583	0.204	0.591
19	5.000	4.000	20.000	2.583	0.204	0.591
20	5.000	4.000	20.000	2.583	0.204	0.591
21	5.000	4.000	20.000	2.583	0.204	0.591
22	5.000	4.000	20.000	2.583	0.204	0.591
23	5.000	4.000	20.000	2.583	0.204	0.591
24	5.000	4.000	20.000	2.583	0.204	0.591
25	5.000	4.000	20.000	2.583	0.204	0.591
26	5.000	4.000	20.000	2.583	0.204	0.591
27	5.000	4.000	20.000	2.583	0.204	0.591
28	5.000	4.000	20.000	2.583	0.204	0.591
29	5.000	4.000	20.000	2.583	0.204	0.591
30	5.000	4.000	20.000	2.583	0.204	0.591
31	5.000	4.000	20.000	2.583	0.204	0.591
32	5.000	4.000	20.000	2.583	0.204	0.591
33	5.000	4.000	24.600	2.582	0.204	0.591

## MEMBER DATA: LEGS

SEC LEG TYPE	DIMENSIONS (IN)	XSECT (SQIN)	J (IN**4)	POUNDS PER FT	SQFT PER FT
1 PIPE	3.500x 0.300	3.016	3.894	10.263	0.173
2 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
3 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
4 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
5 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
6 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
7 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
8 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
9 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
10 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172
11 PIPE	3.500x 0.300	3.016	3.894	10.263	0.172

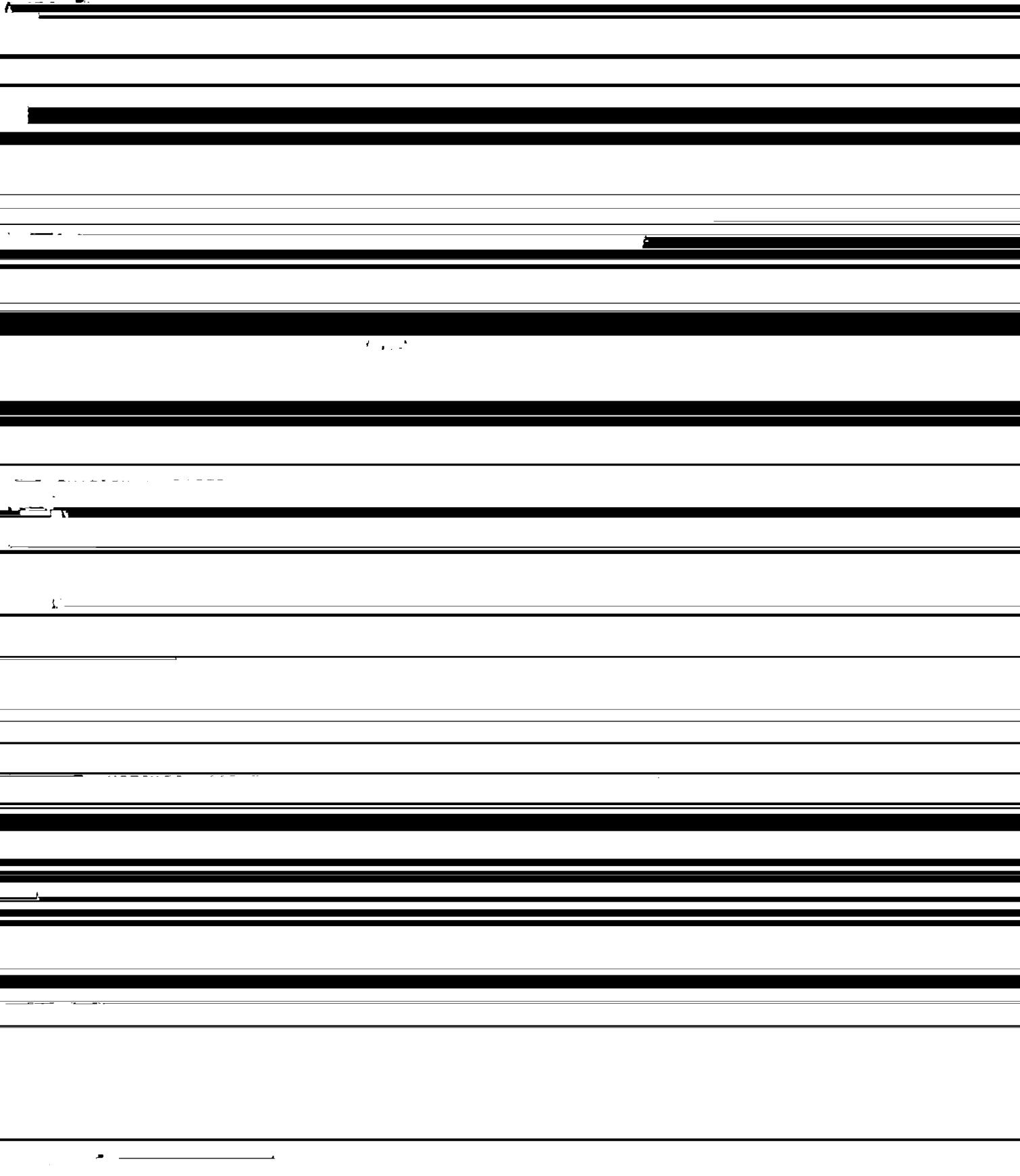
## MEMBER DATA: DIAGONALS

SEC	DIAG	DIMENSIONS	POUNDS	SQFT	PC'S
	TYPE	(IN)	PER FT	PER FT	
1	ROD	0.625	1.044	0.031	24
2	ROD	0.625	1.044	0.031	24
3	ROD	0.625	1.044	0.031	24
4	ROD	0.625	1.044	0.031	24
5	ROD	0.625	1.044	0.031	24
6	ROD	0.625	1.044	0.031	24
7	ROD	0.625	1.044	0.031	24
8	ROD	0.625	1.044	0.031	24
9	ROD	0.625	1.044	0.031	24
10	ROD	0.625	1.044	0.031	24
11	ROD	0.625	1.044	0.031	24
12	ROD	0.625	1.044	0.031	24
13	ROD	0.625	1.044	0.031	24
14	ROD	0.625	1.044	0.031	24
15	ROD	0.625	1.044	0.031	24
16	ROD	0.625	1.044	0.031	24
17	ROD	0.625	1.044	0.031	24
18	ROD	0.625	1.044	0.031	24
19	ROD	0.625	1.044	0.031	24
20	ROD	0.625	1.044	0.031	24
21	ROD	0.625	1.044	0.031	24
22	ROD	0.625	1.044	0.031	24
23	ROD	0.625	1.044	0.071	24
24	ROD	0.625	1.044	0.031	24
25	ROD	0.625	1.044	0.031	24
26	ROD	0.625	1.044	0.031	24
27	ROD	0.625	1.044	0.031	24
28	ROD	0.625	1.044	0.031	24
29	ROD	0.625	1.044	0.031	24
30	ROD	0.625	1.044	0.031	24
31	ROD	0.625	1.044	0.031	24
32	ROD	0.625	1.044	0.031	24
33	ROD	0.625	1.044	0.031	30

## MEMBER DATA: HORIZONTALS

SEC HORTZ TYPE	DIMENSIONS (IN)	POUNDS PER FT	SQFT PER FT	PCS
1 ROD	1.000	2.673	0.049	15
2 ROD	1.000	2.673	0.049	15
3 ROD	1.000	2.673	0.049	15
4 ROD	1.000	2.673	0.049	15
5 ROD	1.000	2.673	0.049	15
6 ROD	1.000	2.673	0.049	15
7 ROD	1.000	2.673	0.049	15
8 ROD	1.000	2.673	0.049	15
9 ROD	1.000	2.673	0.049	15
10 ROD	1.000	2.673	0.049	15
11 ROD	1.000	2.673	0.049	15
12 ROD	1.000	2.673	0.049	15
13 ROD	1.000	2.673	0.049	15
14 ROD	1.000	2.673	0.049	15
15 ROD	1.000	2.673	0.049	15
16 ROD	1.000	2.673	0.049	15
17 ROD	1.000	2.673	0.049	15
18 ROD	1.000	2.673	0.049	15
19 ROD	1.000	2.673	0.049	15
20 ROD	1.000	2.673	0.049	15
21 ROD	1.000	2.673	0.049	15
22 ROD	1.000	2.673	0.049	15
23 ROD	1.000	2.673	0.049	15
24 ROD	1.000	2.673	0.049	15
25 ROD	1.000	2.673	0.049	15
26 ROD	1.000	2.673	0.049	15
27 ROD	1.000	2.673	0.049	15
28 ROD	1.000	2.673	0.049	15
29 ROD	1.000	2.673	0.049	15
30 ROD	1.000	2.673	0.049	15
31 ROD	1.000	2.673	0.049	15
32 ROD	1.000	2.673	0.049	15
33 ROD	1.000	2.673	0.049	18

/TPRFP/ TRANSMISSION LINE PREPARATION  
JOB: 666 Ft. Sed Tower - 75 MPH Basic Velocity, ETA 222F, REVISED ANALYSIS  
6  
23 TRANSMISSION LINES  
7 SPANS  
BASIC WIND VELOCITY: 75,000



## SPAN DATA

SPAN	LENGTH (FT)	WIND PRES (PSF)	XMSN WT (KIPS)	WIND LOAD (KIPS)
1	93.500	16.928	1.915	2.853
2	95.167	22.655	2.064	4.351
3	95.167	26.295	1.814	4.858
4	95.167	28.975	1.711	5.204
5	94.500	31.138	1.484	5.088
6	95.167	32.978	1.308	4.590
7	94.432	34.591	1.057	3.302

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/TPREP/ TRANSMISSION LINE PREPARATION  
 JOB: 666' Guyed Tower - 75 MPH Basic Vel., FIA 222E, XMSN LINES IN ONE BUNDLE

## 23 TRANSMISSION LINES

## 7 SPANS

BASIC WIND VELOCITY: 75.000  
 ICE RADIUS : 0.000  
 GUST RESPONCE (GH) : 1.041  
 BASEPIER ELEVATION : 1.000  
 THIS RUN USED FIA 222-E

## TRANSMISSION LINE DATA

NO	DESCRIPTION	LBS/FT	SQFT/FT	EXPOSURE (%)	ELEVATION (FT)	
					LOWER	UPPER
1	LADDER	5.00	0.2250	100.00	10.00	664.00
2	3-1/8" R.C.	2.60	0.3125	100.00	10.00	664.00
3	1" COND.	1.68	0.1315	100.00	10.00	664.00
4	7/8" HELIAX	0.54	0.1110	100.00	10.00	650.00
5	3" HELIAX	1.80	0.3030	100.00	10.00	638.00
6	1-5/8" HELIAX	1.04	0.1980	100.00	10.00	580.00
7	7/8" HELIAX	0.54	0.1110	75.00	10.00	537.00
8	7/8" HELIAX	0.54	0.1110	75.00	10.00	523.00
9	7/8" HELIAX	0.54	0.1110	50.00	10.00	511.00
10	7/8" HELIAX	0.54	0.1110	50.00	10.00	501.00
11	7/8" HELIAX	0.54	0.1110	25.00	10.00	486.00
12	7/8" HELIAX	0.54	0.1110	25.00	10.00	403.00
13	7/8" HELIAX	0.54	0.1110	25.00	10.00	402.00
14	7/8" HELIAX	0.54	0.1110	25.00	10.00	393.00
15	7/8" HELIAX	0.54	0.1110	25.00	10.00	375.00
16	7/8" HELIAX	0.54	0.1110	25.00	10.00	363.00
17	7/8" HELIAX	0.54	0.1110	0.00	10.00	289.00
18	1-5/8" HELIAX	1.04	0.1980	0.00	10.00	230.00
19	1-5/8" HELIAX	1.04	0.1980	0.00	10.00	190.00
20	1-5/8" HELIAX	1.04	0.1980	0.00	10.00	170.00
21	7/8" HELIAX	0.54	0.1110	0.00	10.00	119.00
22	7/8" HELIAX	0.54	0.1110	0.00	10.00	98.00
23	7/8" HELIAX	0.54	0.1110	0.00	10.00	30.00

666' GU 3 Tower - 75 Mph Basic Vel., FIA 222E, XMSN LINES IN ONE BUNDLE

9

SPAN DATA

SPAN	LENGTH (FT)	WIND PRFS (PSF)	XMSN WT (KIPS)	WIND LOAD (KIPS)
1	93.500	16.928	1.915	2.438
2	95.167	22.655	2.064	3.719
3	95.167	26.295	1.814	4.317
4	95.167	28.975	1.711	4.741
5	94.500	31.138	1.484	4.720
6	95.167	32.978	1.308	4.461
7	94.432	34.591	1.057	3.302

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## 2 CARD DATA: BASIC INFORMATION

7 GUYED FUS  
HINGED BASE  
0.000 INCH RADIAL TIE ON GUYS  
AMBIENT TEMPERATURE = 30.0 DEG F  
INTERMEDIATE LOADS ARE CONSIDERED  
NO INSULATORS ARE CONSIDERED

**3 CARD DATA: GUY LFUFI INFORMATION**

LVL	# GUYS	AVERAGE WIND AT LVL	VELOCITY (MI/HR)	CONCENTRATED LOADS (KIPS)	WFTIGHT	WIND LOAD
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1	3	81,200	0.00	0.00
2	3	87,900	0.00	0.00
3	3	92,600	0.00	0.00
4	3	96,200	0.00	0.00
5	3	99,200	0.00	0.00
6	3	101,700	0.00	0.00
7	3	103,900	0.00	0.00

## 4 CARD DATA: GUY AND LEVER ARM ANGLES

LVL	GUY	ANGLE GUY MAKES W/WIND (DEG)	*	ANGLE LEVER ARM MAKES W/WIND (DEG)	
		WIND A	WIND B	WIND C	
1	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
2	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
3	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
4	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
5	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
6	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD
7	ALL	60.00	0.00	30.00	LEVER ARM ANGLE INFO NOT REQD

**5 CARD DATA: INTERMEDIATE LOAD INFORMATION**

NO	ELEV (FT)	CONCENTRATED LOADS (KIPS) WEIGHT	WIND LOAD
1	29.0	0.10	0.08
2	98.0	0.10	0.09
3	119.0	0.10	0.09
4	160.0	0.10	0.09
5	170.0	0.10	0.09
6	180.0	0.10	0.09
7	190.0	0.10	0.25
8	230.0	0.20	0.30
9	289.0	0.10	0.14
10	363.0	0.10	0.15
11	375.0	0.10	0.15
12	393.0	0.10	0.15
13	402.0	0.10	0.15
14	403.0	0.10	0.16
15	485.0	0.10	0.16
16	501.0	0.10	0.16
17	511.0	0.10	0.16
18	523.0	0.10	0.17
19	537.0	0.10	0.17
20	549.0	0.15	0.24
21	569.0	0.15	0.24
22	589.0	0.15	0.24
23	609.0	0.15	0.24
24	629.0	0.15	0.24
25	638.0	0.15	0.20
26	648.0	0.15	0.20
27	650.0	0.10	0.18

## 6 CARD DATA: GUY CABLE INFORMATION

LVL	GUY #	DISTANCE (FT)	TENS VERT	STRAND (KIPS)	UNIT WT TYPE	DIAM (LB/FT)	(IN)	AE (KIPS)	RS (KIPS)	LEVER ARM (FT)
1	ALL	260.00	103.50	5.00	EHS7	0.8130	0.6250	4700.	42.40	2,500
2	ALL	260.00	198.50	5.00	EHS7	0.8130	0.6250	4700.	42.40	2,500
3	ALL	260.00	294.00	6.00	EHS19	1.1550	0.7500	6720.	58.30	2,500
4	ALL	400.00	393.50	4.00	EHS7	0.8130	0.6250	4700.	42.40	2,500
5	ALL	400.00	488.00	6.00	EHS19	1.1550	0.7500	6720.	58.30	2,500
6	ALL	400.00	583.00	6.00	EHS19	1.1550	0.7500	6720.	58.30	2,500
7	ALL	400.00	678.00	12.00	EHS19	2.0730	1.0000	11940.	104.50	2,500

## 9 CARD DATA: PULL-OFF INFORMATION

WEIGHT (KIPS)	WIND LOAD (KIPS)	MOMENT (KIP-FT)	TORQUES (KIP-FT)		
			WIND A	WIND B	WIND C
17.00	8.90	393.60	0.00	0.00	0.00

## 10 CARD DATA: PANEL INFORMATION

SPAN	PANEL HEIGHT (FT)			\$ UNTF
	TOP	BOTTOM	UNIFORM	PANELS
1	5.000	3.500	5.000	17
2	5.084	5.083	5.000	17
3	5.084	5.083	5.000	17
4	5.084	5.083	5.000	17
5	4.750	4.750	5.000	17
6	5.084	5.083	5.000	17
7	4.716	4.716	5.000	17

\$